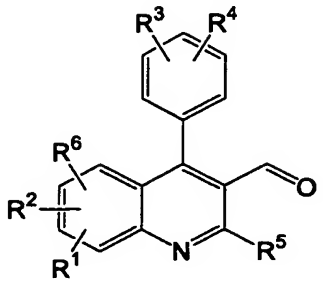
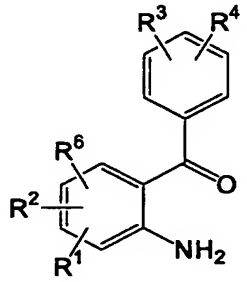
CLAIMS

1. A production method of quinolinecarbaldehyde of the formula (IV)



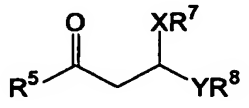
(IV)

wherein R^1, R^2, R^3, R^4 and R^6 are each a hydrogen atom, a halogen atom, an optionally protected hydroxyl group, an optionally substituted alkyl group, an optionally substituted aryl group, an optionally substituted aralkyl group, an optionally substituted alkoxy group, an optionally substituted aryloxy group, or $R^9R^{10}N$- wherein R^9 and R^{10} are each an optionally substituted alkyl group, R^1 and R^2 are optionally linked to show -CH=CH-CH=CH- and R^5 is an optionally substituted alkyl group or an optionally substituted aryl group, which comprises reacting aminobenzophenone of the formula (I)



(I)

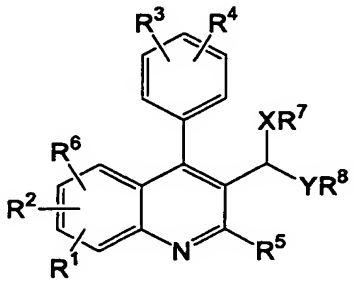
wherein R^1, R^2, R^3, R^4 and R^6 are as defined above, with a β-ketoaldehyde derivative of the formula (II)



(II)

wherein R^5 is as defined above, R^7 and R^8 are each an optionally substituted alkyl group, an optionally substituted acyl group or an optionally substituted aralkyl group, or linked to show

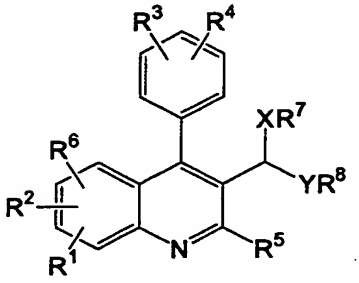
an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom, in the presence of an acid to give a quinolinecarbaldehyde derivative of the formula (III)



(III)

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, X and Y are as defined above, and then hydrolyzing said quinolinecarbaldehyde derivative.

2. A production method of a quinolinecarbaldehyde derivative of the formula (III)

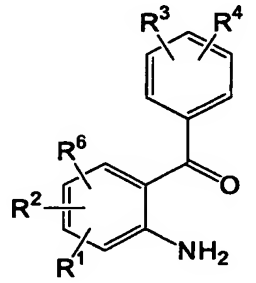


(III)

wherein R^1, R^2, R^3, R^4 and R^6 are each a hydrogen atom, a halogen atom, an optionally protected hydroxyl group, an optionally substituted alkyl group, an optionally substituted aryl group, an optionally substituted aralkyl group, an optionally substituted alkoxy group, an optionally substituted aryloxy group, or $R^9R^{10}N-$ wherein R^9 and R^{10} are each an optionally substituted alkyl group, R^1 and R^2 are optionally linked to show $-CH=CH-CH=CH-$, R^5 is an optionally substituted alkyl group or an optionally substituted aryl group, R^7 and R^8

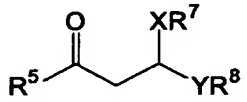
are each an optionally substituted alkyl group, an optionally substituted acyl group or an optionally substituted aralkyl group, or linked to show an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom,

which comprises reacting aminobenzophenone of the formula (I)



(I)

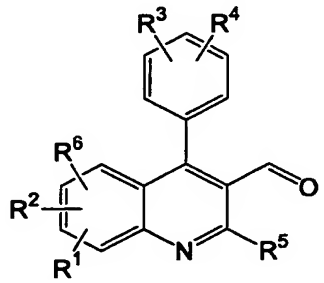
wherein R^1, R^2, R^3, R^4 and R^6 are as defined above, with a β-ketoaldehyde derivative of the formula (II)



(II)

wherein R^5, R^7 and R^8 are as defined above, in the presence of an acid.

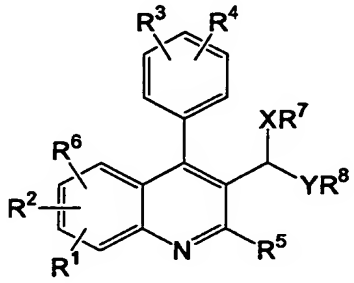
3. A production method of quinolinecarbaldehyde of the formula (IV)



(IV)

wherein R^1, R^2, R^3, R^4 and R^6 are each a hydrogen atom, a halogen atom, an optionally protected hydroxyl group, an optionally substituted alkyl group, an optionally substituted aryl group, an optionally substituted aralkyl group, an

optionally substituted alkoxy group, an optionally substituted aryloxy group, or $R^9R^{10}N$- wherein R^9 and R^{10} are each an optionally substituted alkyl group, R^1 and R^2 is optionally linked to show -CH=CH-CH=CH- and R^5 is an optionally substituted alkyl group or an optionally substituted aryl group, which comprises hydrolyzing a quinolinecarbaldehyde derivative of the formula (III)



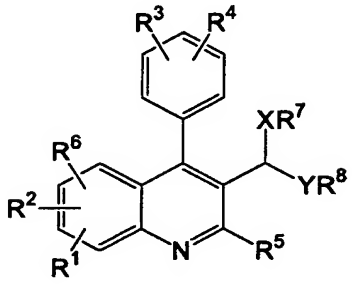
(III)

wherein R^1, R^2, R^3, R^4, R^5 and R^6 are as defined above, R^7 and R^8 are each an optionally substituted alkyl group, an optionally substituted acyl group or an optionally substituted aralkyl group, or linked to show an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom.

4. The production method of claim 1, wherein, in each formula, R^1, R^2, R^3 and R^6 are hydrogen atoms, R^4 is a halogen atom, R^5 is an alkyl group having 1 to 6 carbon atoms, R^7 and R^8 are linked to show an alkylene group, and X and Y are both oxygen atoms.

5. The production method of claim 4, wherein, in each formula, R^1, R^2, R^3 and R^6 are hydrogen atoms, R^4 is a fluorine atom, R^5 is a cyclopropyl group, R^7 and R^8 are linked to show an ethylene group, a trimethylene group, a 2-methyltrimethylene group or a 2,2-dimethyltrimethylene group, and X and Y are both oxygen atoms.

6. A quinolinecarbaldehyde derivative of the formula (III)



(III)

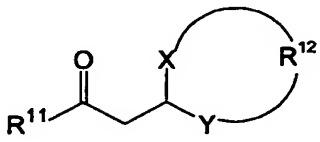
wherein R^1, R^2, R^3, R^4 and R^6 are each a hydrogen atom, a halogen atom, an optionally protected hydroxyl group, an optionally substituted alkyl group, an optionally substituted aryl group, an optionally substituted aralkyl group, an optionally substituted alkoxy group, an optionally substituted aryloxy group, or $R^9R^{10}N$- wherein R^9 and R^{10} are each an optionally substituted alkyl group, R^1 and R^2 are optionally linked to show -CH=CH-CH=CH-, R^5 is an optionally substituted alkyl group or an optionally substituted aryl group, R^7 and R^8 are each an optionally substituted alkyl group, an optionally substituted acyl group or an optionally substituted aralkyl group, or linked to show an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom.

7. The quinolinecarbaldehyde derivative of claim 6, wherein R^1, R^2, R^3 and R^6 are hydrogen atoms, R^4 is a halogen atom, R^5 is an alkyl group having 1 to 6 carbon atoms, R^7 and R^8 are linked to show an alkylene group, and X and Y are both oxygen atoms.

8. The quinolinecarbaldehyde derivative of claim 7, wherein R^1, R^2, R^3 and R^6 are hydrogen atoms, R^4 is a fluorine atom, R^5 is a cyclopropyl group, R^7 and R^8 are linked to show an ethylene group, a trimethylene group, a 2-methyltrimethylene group or a

2,2-dimethyltrimethylene group, and X and Y are both oxygen atoms.

9. A β-ketoaldehyde derivative of the formula (II-1)



(II—1)

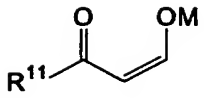
wherein R^{11} is an optionally substituted alkyl group, R^{12} is an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom.

10. The β-ketoaldehyde derivative of claim 9, wherein R^{12} is an optionally substituted alkylene group having 2 to 6 carbon atoms, and X and Y are both oxygen atoms.

11. The β-ketoaldehyde derivative of claim 10, wherein R^{11} is an optionally substituted cycloalkyl group, R^{12} is an ethylene group, a trimethylene group, a 2-methyltrimethylene group or a 2,2-dimethyltrimethylene group, and X and Y are both oxygen atoms.

12. The (-ketoaldehyde derivative of claim 9, wherein R11 is an optionally substituted cycloalkyl group, R12 is an ethylene group, and X and Y are each an oxygen atom or a sulfur atom.

13. A production method of a (-ketoaldehyde derivative of the formula (II-1), which comprises reacting a metal alkoxide compound of the formula (V)



(V)

wherein R11 is an optionally substituted alkyl group and M is an alkali metal, with a compound of the formula (VI)

$$HX-R^{12}-YH \qquad (VI)$$

wherein R12 is an optionally substituted alkylene group, an optionally substituted arylene group or aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom, in the presence of an acid.

14. The production method of claim 13, wherein R11 is an optionally substituted cycloalkyl group, R12 is an alkylene group having 2 to 6 carbon atoms, and X and Y are both oxygen atoms.

15. The production method of claim 14, wherein R11 is an optionally substituted cycloalkyl group, R12 is an ethylene group, a trimethylene group, a 2-methyltrimethylene group or a 2,2-dimethyltrimethylene group, and X and Y are both oxygen atoms.

16. The production method of claim 13, wherein R11 is an optionally substituted cycloalkyl group, R12 is an ethylene group, and X and Y are each an oxygen atom or a sulfur atom.